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In order to assess the impact of different college environments on student development and to provide a source of current, readily available information about college students, the American Council on Education (ACE) has undertaken a large-scale program of longitudinal research on the higher educational system. The program will be based primarily on a comprehensive file of information from a representative sample of higher education institutions which will be updated annually. ACE's research data file is designed to incorporate the best features of a data base (descriptive information that will eventually become outmoded) and a data registry (information that is stored for future use). It will include longitudinal records on students, with special emphasis on student development, and 4 categories of institutional data: finances and financial policies, curriculum, administrative policies and practices, and faculty. The research data file is designed to serve 3 basic functions: research, information, and training, and will possibly be used by other educational organizations and individuals as a research tool. This paper presents a detailed analysis of the rationale, design, current status, and possible applications of the program. (WM)

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A PROGRAM OF LONGITUDINAL RESEARCH ON THE HIGHER EDUCATIONAL SYSTEM

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OFFICE OF RESEARCH
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A Program of Longitudinal Research on the Higher Educational System

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American Council on Education

The Office of Research of the American Council on Education has recently undertaken a large-scale program of longitudinal research on the higher educational system. The major objectives of this program are to assess the impact of different college environments on the student's development and to provide a source of current, readily available descriptive information about the population of college students. A pilot study involving 42,061 entering freshmen at 61 institutions was conducted in the fall of 1965; the full-scale study of entering students in a representative sample of 300 institutions was begun in 1966. The purpose of this report is to present a detailed analysis of the rationale, design, current status, and possible applications of this program of research.

The past few years have seen a significant increase in the number of interinstitutional studies in higher education primarily because of the ease with which quantities of data can be collected and summarized, and because institutional administrators have been extremely cooperative. Most of these studies, however, have used biased or accidental samples of students and institutions. Many have merely been adjuncts to ongoing testing or scholarship programs. In both cases, these projects have tended to focus on specialized concerns, without viewing their possible contribution to the higher education system. Studies of fiscal and administrative practices, for example, have generally failed to deal

directly with the impact of these practices on student development. Similarly, most studies of underachievers and dropouts have been concerned exclusively with student characteristics, and have not attempted to incorporate environmental data into the analyses.

Many of these project-oriented research studies are extremely expensive inasmuch as their data files are of limited usefulness in further research. Because of differences in measurement instruments, sampling techniques, and methods of subject identification, the data from the different investigations are seldom interchangeable, and the researcher initiating a new project typically starts his data collection from scratch. In addition to the duplicative costs of new starts and the excessive use of students' time, this practice means that each new longitudinal study requires an unnecessarily long time to complete.

The initial goal of the American Council on Education's research program is to create and maintain a comprehensive file of longitudinal data from a representative sample of higher education institutions. The research data file has been designed to include the following features: a representative sample of institutions; comprehensive data concerning students, faculty, environments, and administrative policies; and longitudinal data that can be merged with data collected by other investigators. This file will provide the frame of reference for a continuing series of longitudinal studies of the higher education system and, it is hoped, will also serve as a basis for cooperation and coordination of activities among research organizations and individuals concerned with the study of higher education.

Data Files

Most of the large research data files currently in operation or under development are of two types. In the first, most common type, the information is accumulated for some immediate and practical purpose rather than for educational research. For example, the results from the millions of achievement and ability tests administered each year to high school juniors and seniors are used for counseling and for selection or screening purposes. Although such programs have been in operation for many years, their research potential has only recently been considered (Astin, 1965a). The principal limitations of such files are that the samples of subjects and institutions tend to be biased, and that the operational goals of the program restrict the type and amount of research-oriented data that can be collected.

The second type of large data file now in use serves primarily as a repository or library. Here the investigator's main concern is to establish a clearinghouse or a central repository for all the available data pertaining to a given topic. However, since the investigator in this case is largely dependent on data collected by other researchers, his files are usually marred by unrepresentative samples that overlap only partially and by large gaps in information. Clearly, the most useful data file for interinstitutional studies in higher education is one that is designed from the beginning as a tool for research purposes.

Previous experience with large files of data has suggested certain specifications for a research data file. A minimum requirement is that the information be stored as an ordered set of records. These records

should in turn be organized in such a way that they can be retrieved with a minimum of effort for subsequent analyses. In addition, the units of sampling--whether they are individuals or institutions--must be adequately identified. Finally, the anonymity of individuals and institutions must be protected.

A set of records may be called a data "bank," "base," or "registry," depending to some extent on which organization is proposing or developing it. The idea of a data bank, recently popular in educational research, is not new, for it shares many features with other information systems developed in military and medical research and in business data processing.

Data Bases

In the case of data "bases" (a term drawn from military contexts), a primary concern is with updating information on a system. One such example is the master personnel file of the U.S. Air Force, in which are maintained detailed data on all enlisted, officer, and reserve personnel. It is used for identification and selection, for reassignment of personnel, for manpower studies, and for other management purposes. Similarly, the SAGE early warning radar system monitors information on all incoming flights. A characteristic of these data bases is that the information becomes outmoded as time passes and must be deleted from the system. This characteristic reflects a "static" conception in that the immediate concern is with a description of the way things are at a given moment. The data in such a file may be conceived as "descriptive" inasmuch as it provides information about a referent (individual, institution, etc.) in an absolute sense. For example, a person has a particular score on a

given test or has passed or failed a particular item, or an institution falls into an arbitrary category such as "nonsectarian."

Many business data files are basically descriptive in character. For example, the American Airlines Saber System utilizes a central computer to store information about all seats on all planes in the system. When a purchase or seat reservation is made, the event is recorded and an adjustment made in the available inventory. In addition, information is placed in the file giving the name, address, and telephone number of the individual making the transaction. Similarly, cancellations and stand-by requests are deleted and inserted into the file on a "real-time" basis.

Data Registries

Data "registries," in contrast to data bases, are characterized by the need to maintain an historical record over a period of time: that is, a registry contains longitudinal records for all individuals within a data file. In this case, the primary concern is with updating information on an individual. For example, consider the characteristics of psychiatric registries. The intended or "risk" population may be defined as those individuals who contact a member of the psychiatric profession; a longitudinal record (including demographic and socioeconomic data) is maintained in the registry for every individual who has contact with a psychiatric facility.

The individuals (in this case, patients) who enter the system are defined according to their contact through admission to or discharge or transfer from some kind of psychiatric facility. The registry is used for mental health research, planning, and evaluation. The major concern

is with maintaining information over an extended period of time rather than deleting it as soon as possible. Such a system reflects a "dynamic" orientation, where the concern is with the evaluation of change or improvement rather than with a description of the present condition.

Base or Registry?

The data file developed at the American Institute for Research from the Project Talent study (1964) represents still another kind of conception and a very different orientation. In such files information has been accumulated in the course of a large educational research project and is stored for future use. In the sense that the information reflects a representative description of the population being studied at the time of the data collection, it can be characterized as a data "base." On the other hand, the individuals in the file who are followed up are like entries in a data registry. Furthermore, although the data base becomes more and more outdated with time (the data for Project Talent were collected in 1960),the original records are not deleted from the system so that they may remain available for further follow-up studies. In the context of an extended longitudinal study we are thus faced with the prospect of a data file in which the individual records increase indefinitely in size.

The time and expense involved in maintaining so voluminous a data file become all the more unjustifiable when one considers the high probability that much of the original data base will be of little or no value in the future. Thus, some of the information contained in the individual record could be deleted from the system. Yet the present state of the

art, at least in educational research, does not permit us to determine which items will prove most useful in the future. Therefore, as our knowledge increases, we must be alert to determine which information has become outmoded and can be deleted from the file.

The ACE Longitudinal File

The American Council on Education's research data file has been designed to incorporate the best features of both a data base and a data registry. The data files will include longitudinal records on the institutions and individuals selected, as well as current descriptive information on the population. The master data file for this program of research will incorporate all pertinent data concerning higher educational institutions. Whenever relevant, these data will be collected on a continuing basis to keep the base characteristic of the file as current as possible. Figure 1 (see following page) displays the independently accessible data files available from the research program.

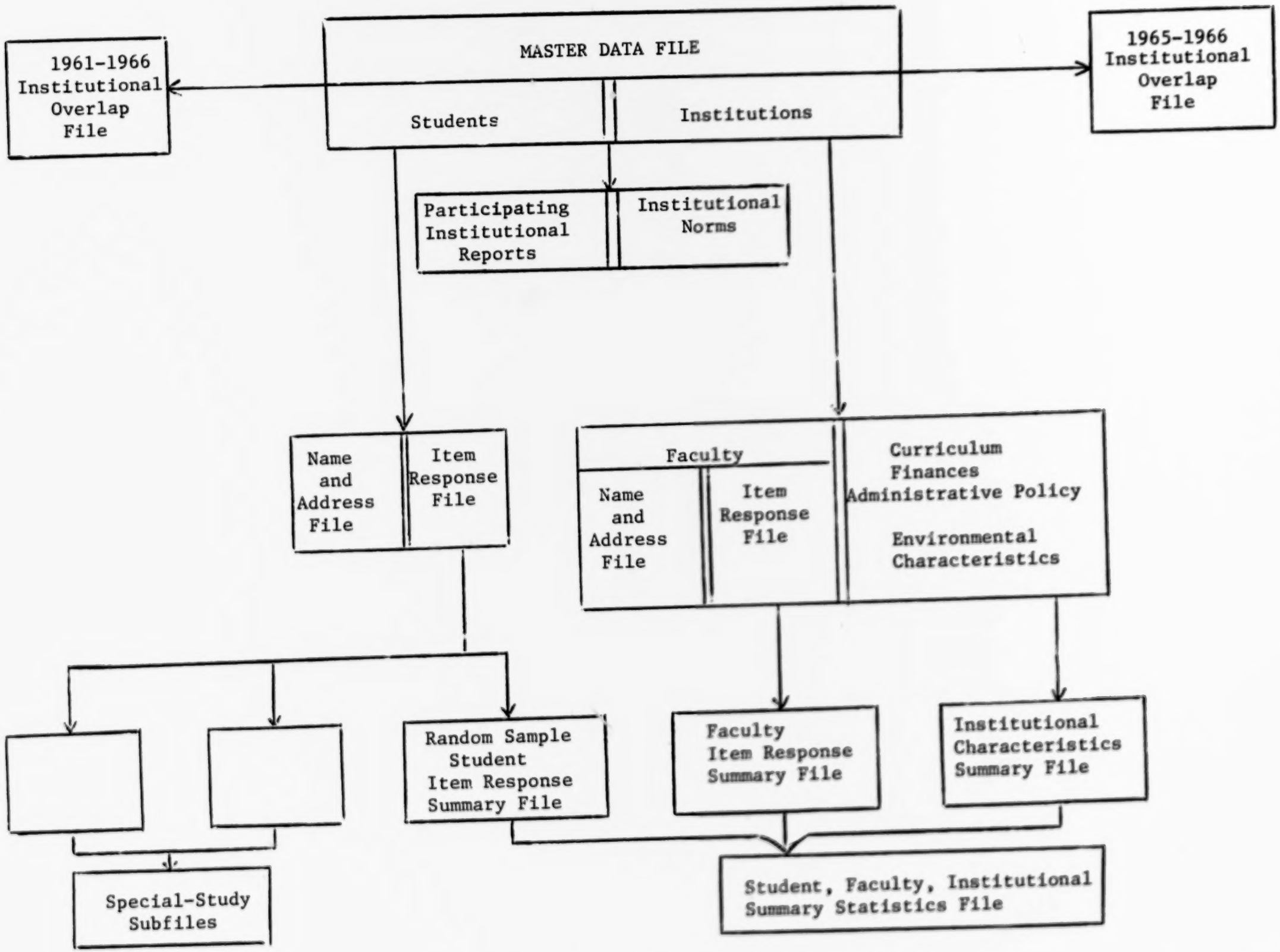
In the following sections we shall discuss the sampling design, the types of data to be included, the organization and structure of the data file, and the conceptual framework for our program of research.

Sampling Design

The primary sampling unit in the research program is the institution. In order to include all institutions of higher education--universities, colleges, junior colleges, and even nonaccredited institutions--the defined population consists of all eligible institutions listed by the U.S. Office of Education in its 1965-66 Education Directory, Part 3,

Figure 1.

Independently Accessible Data Files:* ACE Program of Research on the Higher Education System



Higher Education. "Eligible," here means that the institution is functioning at the time of the survey and has the equivalent of a "freshman" class with at least 30 members. The latter requirement eliminates institutions that require one or more years of undergraduate college-level work for admission to their "first" class. It also eliminates some very small institutions, the growth of which may bring them into the defined population in subsequent years of the program. Under these restrictions, the eligible population consists of 1,968 of the 2,281 institutions listed in the 1965-66 Education Directory.

Stratification of Institutions in the Population

The primary goal in the sampling design was to minimize random errors in order to ensure that the sample was representative of the defined population. Considerations such as costs and logistics, however, led to the adoption of a complex or mixed-strategy design for the research program. As a compromise between the need to reduce costs and the requirement of representativeness, a sample size of about 300 institutions (approximately 15% of the eligible population) was used.

The major control of sampling error is achieved by stratification of the population of institutions along dimensions that are known to represent important functional characteristics of the institutions. Random selection of institutions within different levels of these dimensions thus increases the representativeness of the sample. Although the choice of dimensions for stratification of the population of institutions is ideally determined by the relevance of the various dimensions to control of error, the alternatives are necessarily limited by what information is available.

Astin (1962a) has shown that institutional size (total full-time enrollment) and affluence (per-student expenditures for educational and general purposes) account for the major portion of the variation among four-year institutions in selectivity, financial characteristics, level of faculty training, and curriculum. These two institutional variables are also highly related to the college environment (Astin, 1963a, 1965b; Astin and Holland, 1961) and to the characteristics of the entering students (Astin, 1965c). Affluence is more strongly related to these other factors than size is. Although a measure of size is available on all four-year institutions, information from which affluence can be computed (educational and general expenditures) is available only for most of the regionally accredited four-year institutions (Cartter, 1964).

These early studies provided the rationale for stratification of all four-year institutions. First, the 1,375 eligible four-year institutions were separated into colleges (n = 1,202) and universities (n = 173). (This dichotomy not only is administratively meaningful, but also exerts considerable control over the size dimension.) Next, both groups were separated into 10 levels of affluence ("less than $750" per student, proceeding in $250 steps to "$2,500 or more" per student, plus an "unknown" category).

The sampling design involves different stratification procedures for the two-year and four-year institutions, respectively. These two groups thus define the first major stratum in the eligible population, not only because they represent an important functional dichotomy, but also because recent research indicates that different bases for further stratification of the two groups should be employed. Richards, Rand, and Rand (1965), for example, have recently identified six major characteristics

of junior colleges: cultural affluence, technological specialization, size, age, transfer emphasis, and business orientation. Among other things, their results suggest that enrollment (size) and type of support (dichotomized as public-private) account for a major share of the known differences among the two-year institutions. On the basis of this finding, it was decided to stratify the 592 eligible two-year institutions first by mode of control (public versus private), and then by size.

Sampling Within Cells

In a strictly representative stratified-random sample, a fixed proportion (e.g., 15%) of the institutions in each stratification cell would be picked to define the sample of institutions. This procedure was deliberately modified in several ways to protect against errors resulting from nonparticipation, to reduce the cost per individual student, to protect against accumulating sampling errors in some of the more heterogeneous categories, and to reduce the risk of compounding errors in the aggregate student data. Thus, the universities were deliberately oversampled, since the peculiarities of just a few large institutions could introduce an appreciable bias into the student norms. Although using more large institutions increases some of the logisitic problems, the risk of peculiarity effects is diversified over more institutions, with the data from any one institution receiving relatively less weight in the aggregate pooling operations. In addition to oversampling the universities, institutions were oversampled in the end categories of affluence and enrollment to reduce sampling error arising from the open-ended nature of these categories.

The institutions were initially sorted into the appropriate

stratification cells, the cell members shuffled, and 371 institutions randomly chosen for the contact sample. (An expected rate of cooperation of 80% would yield about 300 participants.) The only departure from strict randomness was the deliberate inclusion in the 371 of 61 institutions that had been selected from a similar stratification design for the 1965 pilot study (Astin and Panos, 1966). The cell counts were adjusted accordingly for the remaining sampling done at random within the stratification cells. An additional 25 institutions, not included as part of the sample, were also selected either by their own request or because they were known to have educational programs of some special interest to the research staff.

In the spring of 1966 an invitation to participate in the study was sent by ACE President Logan Wilson to the presidents of each of the 371 institutions. Positive replies were eventually received from 295 institutions. Since only 16 of the original 371 institutions actually replied that they were unable to participate, the bulk of the nonparticipants consists of institutions that failed to respond at all either to the original invitation or to the two follow-up letters.*

Although the actual rate of participation was almost identical to the expected rate of 80%, there was a large discrepancy between the rates for four-year and two-year institutions (85% and 60% respectively). In particular, it appeared that the smallest of the two-year institutions were the least likely to participate. Since the sample of two-year institutions is thus somewhat smaller than anticipated, several additional

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* We are indebted to Dr. Edmund J. Gleazer, Jr., executive director of the American Association of Junior Colleges, who kindly assisted us in enlisting the interest and cooperation of the two-year institutions.

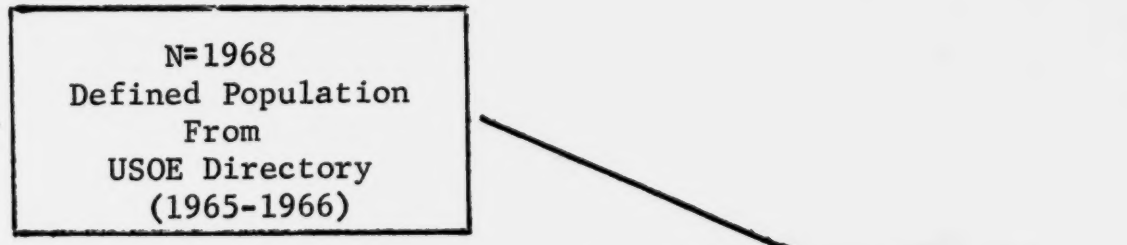
two-year institutions will be invited to participate in the 1967 survey of entering freshmen.

Figure 2 (see following page) shows the eligible population stratified into the 28 sample cells together with the number of participants in each cell. Since the data from a few of the participants may not be usable because of inadequate sampling of their entering freshmen classes, we expect that the actual number of participating institutions to be included in the 1966 norms will be a few less than 295.

The disproportionate sampling from the various stratification cells requires that data from participating institutions in each stratification cell be weighted to equate the cell proportions with those of the defined population. Data collected within institutions will be further adjusted to correct for incomplete participation of <u>individuals</u> within institutions. The final set of weights will be presented in subsequent reports of normative data.

In summary, the sampling of the four-year institutions appears to have been even more successful than expected. In the two-year institutions, however, especially those under private control, a higher rate of nonparticipation was encountered than expected. In light of this experience, and in view of the fact that this segment of the population is rapidly changing, the sampling in subsequent years of the research program will provide for greater representation of two-year institutions, with appropriate changes in weights.

Figure 2.
Sampling Design: ACE Program of Research on the Higher Education System



Enrollment:

	Public Pop.	Public Sample	Private Pop.	Private Sample
Less than 500	111	3	136	2
500 - 999	99	3	37	3
1000 - 2499	108	5	27	5
2500 - 4999	40	4		
5000 or more	35	6		
TOTALS	393	21	200	10

Affluence:*

	Colleges Pop.	Colleges Sample	Universities Pop.	Universities Sample
Unknown	254	10	14	2
Less than 750	109	22	10	4
750 - 999	234	22	7	4
1000 - 1249	236	21	18	6
1250 - 1499	160	24	24	11
1500 - 1749	78	20	11	5
1750 - 1999	51	24	24	13
2000 - 2249	21	9	20	15
2250 - 2499	20	9	13	6
2500 or more	39	20	32	17
TOTALS	1202	181	173	83

* Per student expenditures for educational and general purposes as reported in American Universities and Colleges (Cartter, 1964).

Kinds of Data

The most readily available source of information about higher educational institutions is the student. Students are, in some respects, a captive audience and have become accustomed to completing a variety of questionnaires, forms, tests, inventories, booklets, and the like. The considerable interest of researchers and administrators in student data (probably regarded by the students themselves as unnecessarily redundant) is easily understood.

Presumably, an institution of higher education functions to help the student become an adult by providing appropriate and relevant experiences. Only by learning something about the student, and how he changes during college, can the people responsible for defining educational objectives and for structuring particular learning experiences discover what their programs in fact accomplish. It is here, in studies focused on students, that the principal justification for the elaborate and expensive system of higher education becomes evident. Information about the student and his development is, in short, the core of the research program.

In addition to student data, there are at least four categories of information about institutions of higher education that have been considered important, as is evidenced by the large amounts of literature reporting on or alluding to them: finances and financial policies; curriculum; administrative policies and practices; and faculty. It has already been demonstrated that collecting information in the first three categories, finances, curriculum, and administrative practices, is practical. For example, the American Council on Education's quadrennial

publications American Universities and Colleges and American Junior Colleges contain detailed data on endowment, operating budget, income, and a variety of institutional characteristics and programs. However, these data are currently available only in printed form. The incorporation of these data into the master file will make these and related financial, curricular, and administrative data readily available in a useful form and might prompt further evaluation of what items of information are most valid for specific purposes.

Information about faculty is generally not available, although it is obvious that studies of faculty work loads, preparation, and migration, for instance, would be of great value to a wide variety of persons, agencies, and organizations interested in higher education. The reason for the gap is not clear: perhaps faculty are reluctant to provide information about themselves; perhaps researchers have deliberately disregarded this area. Nevertheless, Cartter's recent studies of faculty quality (1966) and Brown's study of the college teacher market (1965) demonstrate that such information can be obtained.

Conceptual Framework for the Research Program

The history of science is the history of the application of inductive, inferential procedures to experiential data. The various methodologies for generating experiential data can be classified into three broad categories: experimental, quasi-experimental, and nonexperimental.

Experimental procedures are characterized by the random assignment of the experimental units to the treatment conditions. Randomization is usually assumed to be both necessary and sufficient in order to avoid ambiguity in the interpretation of the relationship between the independent and dependent variables; that is, to eliminate the necessity of taking into account the effect of variables not part of the experiment, and to assure the validity of the application of statistical significance tests. However, a single isolated "true" experiment is often of limited usefulness, since replication of the experimental conditions on any substantial scale is rarely feasible in social settings. Without the possibility of such replication, the value of experimental research is more theoretical than practical. Furthermore, it is seldom possible (or even desirable) to assign the experimental units of ultimate concern in educational research (students) at random to various educational experiences.

Quasi-experimental procedures are characterized by the recognition that randomization is not possible, but that sufficient control either of the treatment conditions or of the selection biases can be introduced to rule out some of the alternative explanations of the results. Campbell (1957) has studied the problem of experimentation in social settings in great detail. In the Handbook of Research on Teaching, he and Stanley (1963) outline a number of research designs that permit minimal bias inferences from such situations. Quasi, or socially relevant, experiments represent, perhaps, the only inferential paradigms applicable to the study of the impact of existing institutional programs (i.e., college environments) upon the student. It should be noted, however, that even in the

ideal quasi-experimental setting it is not possible to ensure complete control of bias.

Nonexperimental inference is characterized by the development of models interrelating variables of concern in a conceptually meaningful way, and by the testing of such models against the data. In this case, the concern is with formulating and fitting models to experiential data, no matter how observed, in which randomization or direct control of the treatments is deemed either not possible or irrelevant.

In the Council's research program, the primary unit of sampling is the institution. Nevertheless, the primary unit of concern is the student. Obviously, it is not possible to assign students at random to institutions. Furthermore, our entire program of research is designed to explore and to evaluate alternative methodological and theoretical approaches to the measurement of college environments and to the assessment of their differential impact on the student. Therefore, the quasi-experimental and nonexperimental modes of inference are deemed more appropriate to our research program than is the traditional experimental mode of inference.

The Research Model

For the purposes of our research model, information about higher educational institutions can be sorted into three conceptually distinct categories: outputs, inputs, and operations.

Outputs are the operational manifestations of educational objectives. Although these objectives can be expressed at very high levels of abstraction (for example, "the ultimate welfare of humanity"), we shall

be concerned initially with those relatively immediate objectives that can be assessed directly through research. More specifically, we are referring to the behaviors of the students and faculty that the higher educational institution is attempting to influence. In the case of the student, these would include his achievements, knowledge, skills, values, interests, personality, and behavior toward his fellow man. Faculty outputs would include teaching competence, scholarly productivity, and job stability. (Although the rest of our discussion will, for simplicity, focus only on student outcomes, the model is equally applicable to studies of faculty.) Adequate measures of relevant educational outputs are, clearly, the sine qua non of meaningful educational research (Astin, 1964a).

Studies of student development in higher education have concentrated on intellectual or cognitive outcomes (Fishman, 1962), even though the educational enterprise is concerned with the student's total personal development. Although the research program will utilize the standard measures of educational outcomes (grades, persistence in college, later vocational achievement), an important feature of the research will be the broadening and improvement of techniques for assessing student outcomes in the noncognitive or behavioral domain. New measures will be incorporated into the longitudinal data file as they are developed.

Inputs are the talents, skills, aspirations, and other potentials for growth and learning that the student brings with him into the higher educational institution. These inputs are, in a sense, the raw materials with which the institution has to deal. In collecting input information, it is of vital importance to measure all variables that are likely to

affect the student's subsequent performance on the various outputs under study.

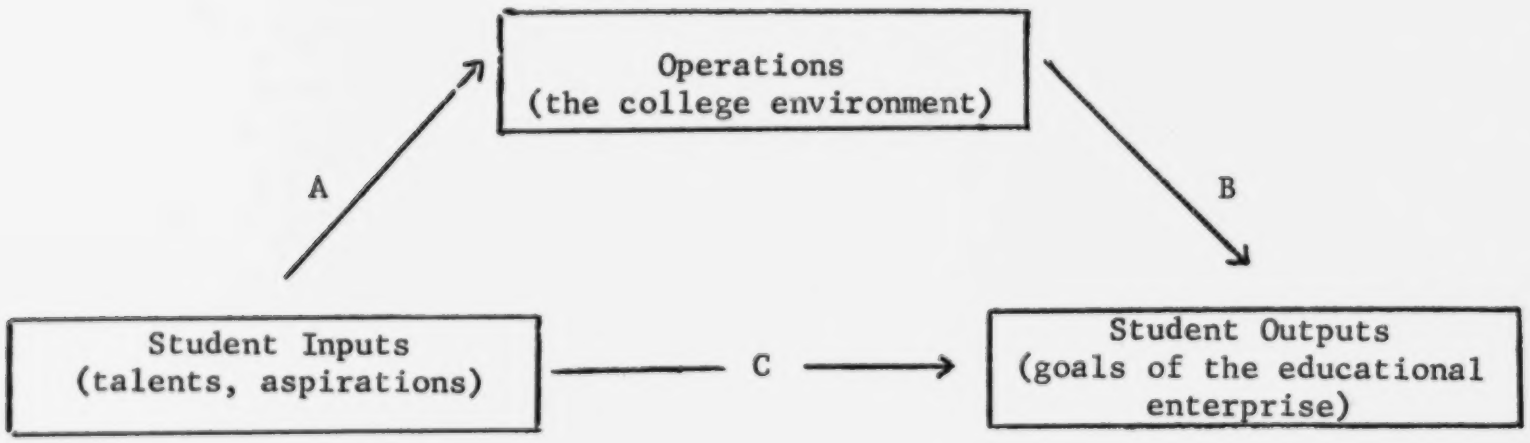
Operations are those aspects of the higher educational institution that are capable of affecting the development of the student. These include administrative policies and practices, curriculum, physical plant and facilities, teaching practices, peer associations, and other characteristics of the college environment. Although some progress in the assessment of institutional environments has been made in recent years, the measurement of the college environment is still in a relatively primitive state both conceptually and methodologically. Consequently, one of the major goals of this research program is to develop and to test improved measurement techniques relevant to the problem of the college environment and its effect upon the student in a manner that will permit the statement of, and the testing of, rival hypotheses.

In contrast to previous research on college environments, we view the college environment simply as a set of potential stimuli. The term "stimuli" refers here to those events or observable characteristics of the college that are capable of changing the sensory input to the student attending the college. The basic task, then, is to identify observable events or characteristics of the institution that could serve as possible stimuli to the student. Our "stimulus" rationale can perhaps be made clearer by a comparison with previous approaches to assessing the college environment.

The work of Pace and Stern (1958) and the later work of Pace (1964) and Thistlethwaite (1960) exemplifies the impressionistic or "image" approach to assessment of the college environment. In this approach, the student is

asked to rate his environment by means of a set of items similar to those typically found in personality inventories. Although a few of the items in these inventories are relatively objective and unambiguous, the majority of items ask for subjective judgments and impressions from the student observers concerning the total "climate" of the institution. In the work done by Astin and Holland (1961) with the Environmental Assessment Technique (EAT), the college environment was assessed through knowledge of the personal characteristics of the students at the institution. It can be seen that neither of these sources of information (impressions of the environment, and personal characteristics of the students) adequately meets the criterion of a potential stimulus. Thus, while the student's subjective impression of his college environment may give rise to certain behaviors that can in turn serve as stimuli for other students, the subjective impression per se does not constitute a stimulus. Similarly, neither the student's degree of intelligence nor his personality characteristics constitute a stimulus by our definition, although these traits may be manifest in certain typical behaviors that can then affect his fellow students.

A model for interinstitutional research on student development based on these three types of information is shown below:



The principal objective in our research program is to determine how the various educational environments represented by higher educational institutions (operations) affect the performance of the student (outputs). We are, therefore, primarily concerned with relationship B in the diagram shown above. From a methodological point of view, however, a thorough knowledge of relationships A and C is required before we can adequately interpret relationship B .

With respect to relationship C, the experience of many years of research on predicting human performance shows that the student's output performance will be determined, in part, by his input characteristics. More simply: the student's talents and aspirations when he enters college will play a major role in determining what he is able to learn and the kind of person he eventually becomes.

But it is the presence of relationship A that complicates the design. It has been established in several major empirical studies that certain characteristics of the college environment are closely related to student input characteristics (Astin, 1963b, 1965c,d; Astin and Holland 1961). The student input, therefore, is likely to be related both to output and to the educational operations. Given this dual relationship, it is possible for a significant relationship B to be mediated simply by differential student input to the various environments.

This discussion makes it clear that any obtained relationship between educational practice and student output is necessarily ambiguous so long as no control is exercised over differential student input. The basic research strategy for dealing with this problem is modeled after

several recent studies of differential college influence (Astin, 1962b, 1963b, 1963c, 1964a, 1965d; Nichols, 1964). First, an "expected" output based on the student's input characteristics is computed. The effect of this expected output is then removed from his observed output, producing a "residual" output which is now independent of input:

$$\underline{\text{Output}} - \underline{\text{Expected Output (based on input)}} = \underline{\text{Residual Output (now independent of input)}}$$

The final steps in the analysis are to relate the residual output to the various environmental characteristics, and to search for person-environment interaction effects.

Because of the importance of the design used in these quasi-experiments, a continuing function of the program will be the improvement of techniques for controlling differential student inputs and for identifying significant interactions between student attributes and environmental characteristics. Our eventual goal is to identify those environmental variables that are most important in affecting the development of both students and faculty.

The Freshman Information Form

The Freshman Information Form is designed to serve two functions: first, to obtain standard data for immediate informational purposes; and second, to obtain student input data for research purposes. Thus it contains both basic biographical and demographic items that can be collected annually from each entering class, and a number of more research-oriented items which can be modified regularly in order to cover the widest possible

range of student outcomes. This plan represents a compromise between the requirements of standardization and comparability of obtained information on the one hand, and, on the other, the desirability of maintaining flexibility in research tactics and approaches. The research program should not become a vehicle for promoting any single test or other measurement instrument.

In order to ensure that the basic demographic information items reflected the needs and inclinations of the participating institutions as closely as possible, the 1965 pilot version of the Freshman Information Form was developed in close collaboration with members of the executive committee of the American Association of Collegiate Registrars and Admissions Officers. The final form, which was administered to the 1965 entering freshman classes at 61 institutions, included 14 items of basic demographic information, 13 items concerning educational and vocational plans, 21 self-ratings, and 57 behavorial stimulus items developed in previous research on college environments (Astin, 1965b). Additional modifications were made in the form to be used in 1966 as a result of a conference of representatives from the 61 pilot institutions held shortly after the dissemination of reports based on the 1965 data.

Even though a certain degree of standardization of content from year to year is necessary in order to study trends in demographic characteristics of entering classes, it is difficult to overemphasize the importance of maintaining flexibility in much of the content of the form. Only in this way will it be possible either to pursue promising research leads in greater depth or to explore the potentialities of new ideas,

hypotheses, and techniques. For these reasons, criticisms and suggestions for modifications will be solicited each year from leading educational researchers and administrators for the design of the new edition of the form.

Follow-Up Forms

The purpose of follow-up surveys will be to collect the output data needed to create the longitudinal records that will be used in various research projects. Often the follow-up information will consist simply of post-tests on input pre-test items in the earlier Freshman Information Form. Follow-up forms will also be used to collect information about the college environment.

Information collected through follow-up forms can also be used for purely descriptive purposes, such as the monitoring of trends in student attrition, rates of transfer, choice of different careers, and the pursuit of graduate training.

Major Uses of the Data Files

To contribute substantially to educational policy and practice is the most important long-range function of the program. The ultimate goal of the research is to provide educational administrators, teachers, and others concerned with educational policy with a sound body of empirical knowledge concerning the relative impact of various educational practices. Results of completed projects will be disseminated by means of monographs, books, articles in professional journals, and papers presented at meetings of professional societies and educational organizations.

Research

Although the American Council on Education's staff will conduct a wide variety of continuing longitudinal studies with the data, the nature of the files is such that their full research potential could never be exploited fully by the in-house staff. Accordingly, the Council will regularly invite researchers from other organizations and institutions to spend some time at the Council in order to pursue their special research interests.

The program provides an opportunity for a wide variety of substantive studies in higher education. Some of the areas of research that can profitably be explored are:

Studies of Student Development: Effects of different college environments on the student's career choice, personality development, mental health, and educational aspirations; factors affecting student dropouts, including the later vocational development of the dropout.

Studies of Special Educational Programs: Effects of various types of governmental and foundation support on the educational environments of departments and institutions; effects of honors programs.

Manpower Studies: Trends in the career aspirations of students over time; trends in faculty migration; factors influencing the recruitment and retention of faculty.

Studies of Teaching Practices: Development of techniques for evaluating teaching proficiency; effects of specific teaching practices on student development.

The data files also provide an opportunity for collaborative research involving data collected by investigators in other organizations.

The student input data that will be collected each fall, for example, might be linked with data collected earlier from the same students by one or more of the large testing organizations. Such a merging of files would permit longitudinal studies covering periods of time other than the college years.

Since the files will provide data for estimating what differential weights should be applied in order to control for sampling bias, the many institutional studies in higher education now being made by other investigators with accidental and other unrepresentative samples can be improved. The existence of standard items of information will also allow investigators to reduce the redundancy of various research questionnaires. If arrangements can be made for exchanging data with the research organizations, students will not be asked to provide the same information over and over again; the outside research organization will merely have to obtain the "key" information needed in order to link up his records with those in the ACE data files, and the available standardized biographical and demographic data, along with other items of information required for his research, will be available to him. Thus, a significant savings in time and added convenience to other researchers, students, faculty, and institutions may be effected.

Information

Each participating institution will receive a tabulation of data on its entering class and norms for the entire student population and for several subclasses of institutions. The norms will also be available to other interested organizations and individuals.

Experience with the 1965 pilot study indicates that the institutional reports and national student norms can be issued before the end of the fall during which the data are collected.

Over-all, the data files will provide factual information ranging from more or less idiosyncratic and specific items of knowledge to all the information in the files on a given topic at a given time. The Office of Research will routinely publish reports of various normative data from the files. In addition, it will be able to fill requests for specific information made by educational institutions and outside agencies.

In order to provide users with ready access to the data files, the staff of the Office of Research will prepare a library of flexible programs that will perform many of the standard types of data manipulations likely to be needed. This "software package," which will probably be operational before the end of 1967, will include routines for computing summary statistics, cross-tabulations, and multivariate analyses of the files. It is our intention to automate outside users' requests for special analyses of the files by developing a system of data files and related software that is thoroughly documented for use by others. Although an automated data accessing system such as this one requires the potential user to fit his special requests to the available file arrangement and software, it has the advantages of permitting easy and rapid access to the files and of requiring the user to define his needs in very explicit terms.

Although all the types of requests for information cannot be

anticipated, some examples of frequent requests (which might require expensive surveys were the information needed but not readily available) are: personal characteristics of students entering various types of institutions; analyses of how various types of students finance their education; trends in student choices of careers; and the distribution of scholarship and fellowship funds.

These examples merely suggest the wealth of information services that can be performed with the data files. It is apparent that the availability of standard biographical and demographic information together with other research information collected from the students at a representative national sample of higher educational institutions would be of considerable use in educational planning and policy.

Training

Much of the training of professional educational researchers takes place in the university setting. The impetus provided by federally financed programs for setting up committees of educational measurement and statistical analysis has given rise to many new graduate programs in educational research and methodology. A primary function of such programs is to provide the student with a sound theoretical and methodological background. One of the trainee's most frequent complaints is that this emphasis is "too theoretical." This dissatisfaction gives rise to both a demand and a need for practical applications. Since the nature of educational problems often dictates the use of large samples and longitudinal designs, it is likely that the data files can be used as both a research tool for predoctoral and postdoctoral fellows, and, as we have

already suggested, a vehicle for the pursuit of specialized research problems by experienced researchers from other organizations and institutions. The potential researcher can thus have an opportunity to apply his theoretical and technical skills to substantive problems in higher education, even before his formal training is actually completed.

Another important training function currently planned in connection with the program is an annual conference of researchers engaged in interinstitutional studies of higher education. These conferences should be useful in planning for the program and in stimulating communication and collaborative research among different investigators.

Research Projects Currently Planned or Under Way

In this section we provide brief descriptions of projects currently under way or planned by the American Council on Education staff. It should be stressed, however, that the data files are designed to support an ongoing program of studies. The data on educational inputs, outputs, and environments now being incorporated into the files will make it possible to conduct a variety of other longitudinal studies quickly and at a relatively small cost. If a particular research hypothesis cannot be tested adequately with available data, the appropriate new items can be substituted in the flexible portion of the freshman information form.

Origin and Development of the College Environment

A recent theoretical development in higher education research is the concept of the college environment as a "stimulus." This theory has

led to the construction of the Inventory of College Activities (ICA), an instrument that measures the college environment primarily in terms of the frequency of occurrence of various student behaviors. Research with the ICA has shown, in brief, that colleges differ widely in the frequency with which their students exhibit various forms of behavior. An important question, both theoretically and practically, concerns how these different behavioral patterns develop. Are college environments simply a reflection of the types of students initially recruited, or are patterns of student behavior shaped by certain administrative policies, curricular practices, or other factors?

In the proposed study we shall attempt to explore these questions by studying changes in patterns of student behaviors as assessed by the ICA prior to college and after one and two years in college. Selected student behaviors from the ICA, which were included in the 1965 pilot study of entering students, have also been included in the 300-institution input study now under way for 1966.

During the summer of 1967, these same behavioral items will be repeated in a follow-up questionnaire that will be sent to students from both samples. Analyses of data and completion of final reports are expected by December 1968.

An Exploratory Study of the Process of College Choice

One of the critical choice points in the educational development of a student is his selection of a college. Although great amounts of time and effort are expended annually by counselors, students, and parents in deciding on the "right" college, very little is known about how these

choices are made.

If we are to increase our general understanding of this complex decision process, we must learn more about (a) the kinds of information about colleges that are typically available to the high school student; and (b) the sources or channels of communication for this information. Initially, we propose to seek answers to the following questions: How do particular colleges first come to the attention of the prospective college student? What is the relative importance of parents, friends, guidance counselors, and others in directing students toward given colleges? What kinds of information about the college environment are typically available to the student before he actually enrolls? In what areas are the prospective college student's expectations about his college's environment most likely to be inaccurate? Does the accuracy of the student's expectation about his college vary by type of college, type of student, or informational source?

Items to provide answers to these questions have been included in the 1966 student input survey. The student's perception of his college environment will be assessed by means of scales developed in previous research with the Inventory of College Activities. It is expected that this study will be completed by June 1967.

Attrition Among College Students

The attrition of college students is an important criterion for any program of research in higher education. Although the term "dropout" is a negative value judgment--implying both failure and loss--the relevance of attrition to educational planning and practice is manifest from the time

and money spent in studying it. Dropping-out connotes, at one level, individual educational failure; that is, failure either of the student involved or of the educational system. At a broader social level the dropout problem implies a more far-reaching detriment because the presumed talent will not be available to our society in the form of trained manpower.

Research on dropouts will follow the general input-environment-output model described earlier. This continuing project will include several alternative methods of defining the dropout criterion, and provisions for testing the validity of several rival theories commonly advanced to account for student attrition. For example, we have included in the 1966 Freshman Information Form items about the entering student's plans for marriage, his degree of concern about college finances, and the sources he expects to call upon to finance his undergraduate education. These variables are often cited as ex post facto arguments for dropping out of college. For the first time, they are being included as input control variables in a longitudinal study of college student attrition. These variables, together with other student personal variables and environmental measures, will provide a frame of reference to which the later behavior of the dropout can be related. The principal objective of the study is to identify the personal and environmental factors associated with attrition, with special emphasis on those environmental factors that can be manipulated.

Student input data are being collected from the 1966 entering students at the sample institutions, with initial criterion data scheduled

for collection in the fall of 1967. Preliminary findings from the initial one-year longitudinal study will be completed by June 1968. The general plan for the research program is to monitor the students' progress regularly by means of periodic follow-ups, and to use subsequent student input surveys to explore more thoroughly the validity of promising predictor variables.

Career Choice and the College Environment

The undergraduate institution is one of the principal mechanisms for channeling and developing skilled manpower. The potential importance of the college as a determinant of the manpower supply in various fields is illustrated by the fact that more than half of the students who complete their undergraduate education receive degrees in fields different from the ones in which they began their studies. Following the methodology outlined previously, we shall attempt to identify factors in the college environment that influence the student's choice of a career and field of study.

One of the principal limitations of current theories of career development is the inadequate treatment given to environmental factors. With a few exceptions, these theories are exclusively psychological in conception, with only cursory consideration given to the role of environmental constructs in the career development process. One major theoretical hypothesis to be explored in this project is based on a theory of selective environmental reinforcement. Briefly, this hypothesis states that the student's career choice tends to shift in the direction of the dominant or modal choice of his fellow students.

A second hypothesis, related to current theories of career development, concerns the role of the self concept. Specifically, we shall attempt to (a) determine whether changes in career plans are accompanied by appropriate changes in the student's self concept, and (b) explore the role of environmental factors in mediating such changes.

Input data for this project were collected in the fall of 1965. Follow-up data will be collected four years later, in the spring of 1969, at the expected time of graduation from college. Completion of the final report is expected by June 1970.

Methodological Study of Hierarchical Grouping Models for Taxonomy of Institutions

Typically, a priori classification along some obvious "dimensions" is used in educational research, although such dimensions have their major justification for administrative rather than research purposes. Examples of this type of classification are colleges versus universities, or publicly controlled versus privately controlled institutions. Alternative classifications, however, may be more useful in some educational research, especially where these classifications are based on objective measurements of institutional characteristics. A crucial consideration in the use of these empirical models is the sensitivity of the resulting classification to the nature of the input data and to the choice of paired-comparisons measures derived from such data. Certain other characteristics of the models and in the strategies of their application in classifying large numbers of objects (i.e., institutions) require examination and comparison with related models (such as the Leiman-Schmid

hierarchical factor analysis model). Outcomes of the various strategy choices require comparison with each other and with existing a priori classifications.

In the proposed methodological study of the hierarchical grouping models, we shall utilize all four-year institutions included in the sample. Empirical bases of classifications to be compared will include measures of traditional a priori variables, freshman input factor variables, environmental orientation factor variables, and combinations of these. The research will explore the possibility of obtaining control of input factors by stratification of institutions along dimensions so defined. Where different classifications result, normative data from the research files will be extracted for the alternative types. It is anticipated that the methodological studies in the earlier phases of this research can be completed by December 31, 1966, and that subsequent use of the results in working with the substantive data files can proceed during the following year. The earlier phases of detailed planning and of adopting available computer programs are currently under way.

The Use of Co-Twin Controls for Analysis of Nature-Nuture Effects in Educational Research Data

Because of numerous methodological and conceptual difficulties encountered over the years, many educational and psychological researchers have tended to relegate the old "nature-nuture" controversies to the realm of limbo. Since the proposed research program is designed to create data files specifically for research purposes rather than merely to collect data already obtained from various sources and for various purposes,

data bearing on these old questions will be obtained on a large control sample. Since over 200,000 subjects will be involved in the 1966 input survey, some 2,000 sets of twins may be expected in the resulting files. A recent methodological contribution, consisting of a zygosity-diagnosis questionnaire with an accuracy of 93% validated against extensive blood-typing discrimination of twin zygosity, will be used to obtain a low-cost, highly reliable discrimination in the file twins. Assuming about 3 dizygotic to 1 monozygotic pairs in our files, and ignoring differential death rates and institution attendance rates, we may expect 1,500 sets of fraternal twins and 500 sets of identical twins. By Mendelian laws, we may expect 375 each of male fraternal pairs and female fraternal sets and 750 male-female fraternal sets. We may also expect 250 each of male identical sets and female identical sets. In any case, we will know actual numbers from the data, and it is apparent that sufficient numbers of various types of twins should be available for additional factors to be added to analysis of data, and still have enough cases per cell to stabilize statistics.

To the extent permitted by the actual counts, nature-nuture differences will be examined with respect to the following variables: college choice; academic achievement and academic ability; career and higher educational aspirations, including choices of field; accomplishments in high school; perceptions of the college; stated interests and values; and changes observed from follow-up data.

It is important to note that genetically determined factors are necessarily inputs to the educational process and presumably interact with earlier environmental influences. Such interactions are in part

reflected in the student input data obtained at the time of entrance to college. By controlling environmental information in the twin sets, as this is obtained through special follow-ups of the twin samples, it is expected that a residual nature composite may be derived and used to provide a sharper separation and control of confounding effects and interactions in other phases of the program.

Initial identification and count of twins obtained in the basic files should be completed by December 31, 1966, with follow-up zygosity diagnoses and special background questionnaires sent to the twin samples during the second semester of the academic year. Final definition of the twin samples with zygosity discrimination and initial analyses will be completed by June 1967 with a report of preliminary results. Further analyses of the twin data files will then be initiated in the fall of 1967.

Correlates of Birth Order Among Student Outcomes

Recently researchers have been giving more attention to the effect of ordinal family position on the academic achievement and later vocational development of the student. Although a large number of studies indicate the pervasiveness of "birth order effects," the suggested causal relationships are often not testable in the context of the particular study or are contradicted by other research. This result follows from the fact that birth order data are usually collected as ancillary information, without deliberate design, and are then correlated with other data. Thus one of the principal limitations of current hypotheses concerning effects of birth order is the inadequate data collected. Furthermore, these data

are not obtained in a context that permits testing alternative hypotheses.

During the fall 1965 pilot study, birth order data were collected from 42,000 entering students. Preliminary analyses of these data indicate that it is necessary to obtain information with regard to age and sex distributions of siblings within family sizes. This information is needed in order to define and explore the effects of early environmental interactions within the home. These interactions, it is suspected, may offer a major alternative explanation for so-called birth order effects.

The preceding considerations led to the formulation of the birth order item as it appears in the 1966 Freshman Information Form. Input data concerning ordinal family position will be collected in the fall of 1966. This information, together with other personal and environmental measures, will be explored within the framework of a number of hypotheses derived from physiological, sociological, and economic theories. The principal objective of the study is to determine the correlates of birth order effects among student outcomes and to provide insights into the processes underlying the observed effects.

Preliminary findings from the 1966 data will be completed by the fall of 1967. Follow-up data collected from the 1966 sample will be included in further analyses of the birth order data in order to document relationships from the earlier analysis with later student developments. These outcomes will include such student behavior as dropping out of college, final career choice, and length of time required to obtain a degree.

Summary

In this paper we have presented a plan for a broad program of continuing longitudinal research on the American higher educational system. This research program will be based primarily on a comprehensive file of information updated annually from a representative sample of higher education institutions. The file will contain detailed longitudinal information concerning the students and environments of the participating institutions in a readily available and accessible format.

The research data file is designed to serve three basic functions: research, information, and training. It is expected that the data files will be utilized as a research tool by other educational organizations and individuals concerned with higher education. The standardization and resulting comparability of data and the flexible nature of the research program outlined here should make it possible for agencies involved in massive data collection procedures to move more rapidly toward coordination of their own activities and toward cooperation with other agencies performing similar functions.

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American Council on Education

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